

Chapter 1

Introduction to Remote Sensing

1-1 Purpose of this Manual.

a. This manual reviews the theory and practice of remote sensing and image processing. As a Geographical Information System (GIS) tool, remote sensing provides a cost effective means of surveying, monitoring, and mapping objects at or near the surface of the Earth. Remote sensing has rapidly been integrated among a variety of U.S. Army Corps Engineers (USACE) applications, and has proven to be valuable in meeting Civil Works business program requirements.

b. A goal of the Remote Sensing Center at the USACE Cold Regions Research Engineering Laboratory (CRREL) is to enable effective use of remotely sensed data by all USACE divisions and districts.

c. The practice of remote sensing has become greatly simplified by useful and affordable commercial software, which has made numerous advances in recent years. Satellite and airborne platforms provide local and regional perspective views of the Earth's surface. These views come in a variety of resolutions and are highly accurate depictions of surface objects. Satellite images and image processing allow researchers to better understand and evaluate a variety of Earth processes occurring on the surface and in the hydrosphere, biosphere, and atmosphere.

1-2 Contents of this Manual.

a. The objective of this manual is to provide both theoretical and practical information to aid acquiring, processing, and interpreting remotely sensed data. Additionally, this manual provides reference materials and sources for further study and information.

b. Included in this work is a background of the principles of remote sensing, with a focus on the physics of electromagnetic waves and the interaction of electromagnetic waves with objects. Aerial photography and history of remote sensing are briefly discussed.

c. A compendium of sensor types is presented together with practical information on obtaining image data. Corps data acquisition is discussed, including the protocol for securing archived data through the USACE Topographic Engineering Center (TEC) Image Office (TIO).

d. The fundamentals of image processing are presented along with a summary of map projection and information extraction. Helpful examples and tips are presented to clarify concepts and to enable the efficient use of image processing. Examples focus on the use of images from the Landsat series of satellite sensors, as this series has the longest and most continuous record of Earth surface multispectral data.

e. Examples of remote sensing applications used in the Corps of Engineers mission areas are presented. These missions include land use, forestry, geology, hydrology, geography, meteorology, oceanography, and archeology.

f. A glossary of remote sensing terms is presented at the end of this manual, also see <http://rst.gsfc.nasa.gov/AppD/glossary.html>.

g. The Remote Sensing GIS Center at CRREL supports new and promising remote sensing and GIS (Geographical Information Systems) technologies. Introductory and advanced remote sensing and GIS PROSPECT courses are offered through the Center. For more information regarding the Remote Sensing GIS Center, please contact Andrew J. Bruzewicz, Director, or Timothy Pangburn, Branch Chief of Remote Sensing GIS and Water Resources, at 603-646-4372 and 603-646-4296.

h. This manual represents the combined efforts of individuals from Science and Technology Corporation (STC), Dartmouth College, and USACE-ERDC-CRREL. Principal contributors include Lorin J. Amidon (STC), Emily S. Bryant (Dartmouth College), Dr. Robert L. Bolus (ERDC-CRREL), and Brian T. Tracy (ERDC-CRREL).